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(54) **Spinal column deformity correction procedure and device for putting it into practice**

(57) The procedure includes:

Fastening of a bar (1) by means of end pincers (2),
joined to connectors (3).

Union by means of metallic wires (4) of each inter-
mediate pincer (2) with a wire-bar connector (5).

Pulling of the wires (4) from their free ends.

The device for putting the procedure into practice
consists of:

Pincers (2) attached to the vertebrae with double
claw (fixed and mobile).

Pincer-bar connectors (3) with an orifice (15)
through which the bar (1) passes and a cylindrical
prolongation (13) for joining the pincer.

Wire-bar connectors (5) passing through an orifice
(21) with two paths and a curved joint (22) through
which the wire passes.

Wires (4) with an end butt (23) able to be pulled by
its free end.

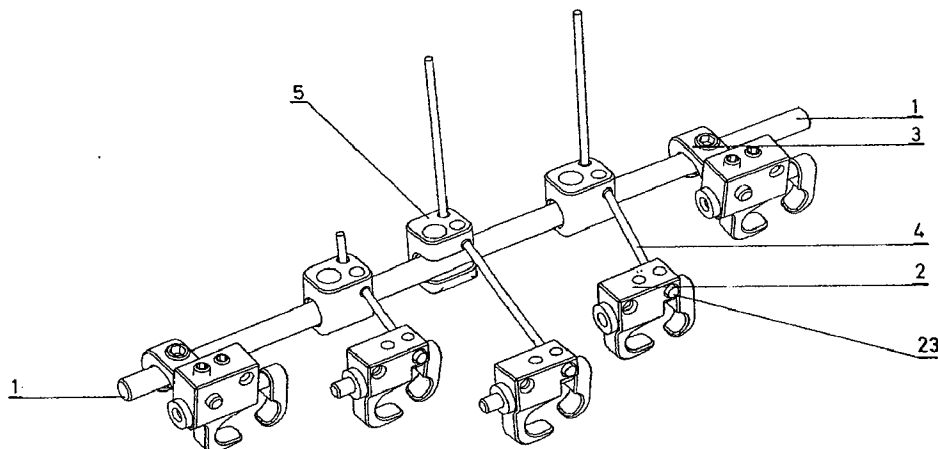


FIG. 6

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Description**PURPOSE**

[0001] The purpose to which the invention refers which is protected by this Patent consists of a "Spinal column malformation correction procedure and device for putting it into practice".

[0002] The malformations for the correction of which both the procedure and the device are applied consist of curvature of the longitudinal axis of the spine when this should be anatomically straight, with both (procedure and device) being apt for correcting any malformation, pathological or traumatic, whatever its origin.

[0003] On the other hand, the claimed procedure admits slight variants that do not alter or impair its essentiality, thus constituting "a group of inventions interrelated in such a way that they integrate a unique general inventive concept".

HISTORY

[0004] Different attachment techniques of the attaching elements posterior to the vertebrae are known, which make up the spinal column malformation correction systems by means of lateral displacement of the vertebrae.

[0005] The preferential fastening of said attaching elements is located on the vertebral laminae as these are the most resistant mooring places of the posterior area of the rachis and, furthermore, the less affected by the osteoporosis processes that weaken the bone structure.

[0006] The failure of various types of instrumentation usually occurs either due to pull-out of the attaching elements or due to the excessive magnitude of the loads applied to the rachis.

[0007] The known and most used attaching elements are the following:

Transpedicular screws: The placing of the screws through the vertebral peduncles implies a high risk of neurological damage as the peduncle can break, damaging the nearby nervous roots or the spinal cord itself. On the other hand, the strength required to remove them is relatively little.

Sublaminar wires: These do not permit the transmission of axial loads to the tying bars, thus causing sliding along them when compression, lateral inclination and flexion displacements are made. Due to the reduced contact surface between the wire and the bone they tend to cut the vertebral laminae.

Claws: These give rise to a connection that is unable to resist flexor and torsion moments as they allow turning movements, although they provide resistance to posterior removal and longitudinal traction-compression forces.

DESCRIPTION OF THE INVENTION

[0008] The purpose of the invention constituting the object of this Patent consists in overcoming the inconvenience characteristic of the known procedures and devices for spinal column malformation correction by means of lateral moving of the vertebrae described above. It has been conceived and designed specifically for this priority purpose.

[0009] The protected procedure is of the type used for application to longitudinal metallic bars that serve as a support when nearing to them the elements attached to the vertebrae, thus obtaining their lateral displacement. It includes the following operations:

Fastening of a longitudinal metallic bar on the concave side of the spinal column curvature by means of pincers attached to the laminar or pedicular zone of the vertebrae and linked to lateral bar-pincer connectors located on top and beneath the deformation, near the ends of the bar.

Union by means of independent metallic wires of each intermediate pincer with a wire-bar connector linked to the bar, retaining an end of each wire at the corresponding pincer by means of prisoner screws and passing the opposite end through the connector.

Progressive traction of all the wires from their free ends that have passed through the connectors, by means of tighteners anchored on the wire-bar connectors, until obtaining approximation of the intermediate pincers and the vertebrae to which they are attached to the longitudinal bar, thus completing correction of the curvature.

Mounting of a second longitudinal bar on the convexity side of the curvature to bilaterally stabilize the spinal column, attaching this second bar to the vertebrae by means of other pincers.

Replacement of the wires by lateral pincer-bar connectors when this is possible due to the proximity of the pincer to the bar.

[0010] The device for putting the described procedure into practice consists of the following elements:

Pincers attached to the vertebrae through their laminar or pedicular zone, formed by two curved claws with opposite concavities, one of which forms part of the body of the pincer and the other independent, with a cylindrical lateral prolongation which on passing tightly through the body of the pincer allows it to make axial or turning displacements to adapt the relative position of the two claws to the shape and sizes of the zone of the vertebra where it is fastened. There is a prisoner screw for immobilization of the movable claw in the suitable position, as well as another prisoner screw to retain insertion of the connecting prolongation of the pincer-bar connector.

tors and tautening wire through-orifice for lateral displacement of the vertebrae.

Pincer-bar connectors that have an orifice or groove for tight housing of the bar with a prisoner screw for its immobilization in the suitable position and a lateral cylindrical prolongation for connection to the corresponding pincer.

Longitudinal metallic bar held on its ends by pincer-bar connectors.

Wire-bar connectors formed by a polyhedral body with beveled edges, crossed by a groove or longitudinal orifice through which the bar passes and to which it is attached by means of a prisoner screw, and by an orifice with two paths (side inlet and upper outlet), joined by curved transition through which the wire passes and a prisoner screw to retain it. This layout facilitates surgical access to the free end of the wire so that it can be tautened.

[0011] Braided metallic wires thanks to the progressive pulling of which by means of conventional tighteners the approximation stress of the vertebrae to the bar is caused. For this purpose a low cylindrical butt is provided on the end projecting through the body of the pincer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] To complete the description of the invention and facilitate the interpretation of its formal, structural and functional characteristics, attached are drawings in which the different aspects of a preferred performance of the device for putting into practice the spinal column malformation correction procedure constituting the object of this Patent.

[0013] In said drawings:

Figure 1 presents a longitudinal section of a pincer fastened to the vertebrae.

Figure 2 represents a perspective view of the union between the bar and pincer by means of a connector.

Figure 3 represents a perspective view of the union of a wire-bar connector to the bar;

figure 4 a transversal section of the same through a vertical plane that diametrically cuts the wire through-orifice; and figure 5 the active position of a wire-bar connector mechanically joining the bar and pincer by means of a wire.

Figure 6 is a general perspective of the correcting device, showing the relative positions of the end pincers linked to the bar by means of pincer-bar connectors and of the intermediate pincers mechanically joined to the bar by means of respective wires through wire-bar cables.

Figure 7 schematically represents the connection of the longitudinal to the column by means of end pincers and pincer-bar connectors.

Figure 8 shows the application of the procedure by means of the device, with correction of the curvature already obtained through lateral displacement of the vertebrae and their approximation to the bar, thanks to the pulling of the wires on the intermediate pincers.

Figure 9 shows bilateral stabilization of the column with a second longitudinal bar.

DESCRIPTION OF A PREFERRED PERFORMANCE

[0014] In order to clearly show the nature and scope of the advantageous application of the "Spinal column malformation correction procedure and device for putting it into practice", constituting the object of the invention, the following is a description of its application and structure, making reference to the drawings which, on representing a preferred performance of the device and its components for information purposes, must be considered in the widest sense and not limitative of the application and content of the claimed invention.

[0015] The claimed correction procedure is of the type that uses, for its application, longitudinal metallic bars serving as a support for nearing the elements attached to the vertebrae to them.

[0016] It includes the following operations:

Fastening of a longitudinal metallic bar (1) on the concave side of the spinal column curvature by means of pincers (2) attached to the laminar or pedicular zone of the vertebrae and linked to lateral bar-pincer connectors (3) located on top and beneath the deformation, near the ends of the bar (1). Union by means of independent metallic wires (4) of each intermediate pincer (2) with a wire-bar connector (5) linked to the bar (1), retaining an end of each wire at the corresponding pincer by means of prisoner screws (6) and passing the opposite end through the connector (5).

Progressive traction of all the wires (4) from their free ends that have passed through the connectors (5), by means of tighteners anchored on the wire-bar connectors, until obtaining approximation of the intermediate pincers (2) and the vertebrae to which they are attached to the longitudinal bar, thus completing correction of the curvature. means of other pincers.

Replacement of the wires (4) by lateral pincer-bar connectors (3) when this is possible due to the proximity of the pincer to the bar.

[0017] The device for putting the described procedure into practice consists of the following elements:

Pincers (2) attached to the vertebrae, formed by two curved claws with opposite concavities, one of which (7) forms part of the body (8) of the pincer and the other (9) independent, with a cylindrical lat-

eral prolongation (10) which on passing tightly through the body (8) of the pincer allows it to make axial or turning displacements to adapt the relative position of the two claws to the shape and sizes of the zone of the vertebra where it is fastened. There is a prisoner screw (11) for immobilization of the movable claw (9) in the suitable position, as well as another prisoner screw (12) to retain insertion of the connecting prolongation (13) of the pincer-bar connectors (3) and tautening wire (4) through-orifice (14) for lateral displacement of the vertebrae.

Lateral pincer-bar connectors (3) that have an orifice or groove (15) for tight housing of the bar with a prisoner screw (16) for its immobilization in the suitable position and a lateral cylindrical prolongation (13) for connection to the corresponding pincer (2).

Wire-bar connectors (5) formed by a polyhedral body (18) with beveled edges, crossed by a groove or longitudinal orifice (19) through which the bar (1) passes and to which it is attached by means of a prisoner screw (20), and by an orifice (21) with two paths (side inlet and upper outlet), joined by curved transition (22) through which the wire (4) passes and a prisoner screw (17) to retain it.

[0018] Braided metallic wires (4) the progressive pulling of which nears the pincers (2) and the vertebrae to which these are attached to the bar (1). For this purpose a low cylindrical butt (23) is provided on the end projecting through the body (8) of the pincer (2).

Claims

1. Spinal column malformation correction procedure of the type that uses, for its application, longitudinal metallic bars serving as a support for nearing the elements attached to the vertebrae to them, **characterized by** the fact that it includes the following operations: Fastening of a longitudinal metallic bar (1) on the concave side of the column curvature by means of pincers (2) attached to the laminar or pedicular zone of the vertebrae and joined to lateral pincer-bar connectors (3) located above and below the deformity, near the ends of the bar (1); Union by means of independent metallic wires of each intermediate pincer (2) with a wire-bar connector (5) linked to the bar (1), retaining an end of each wire at the corresponding pincer (2) by means of prisoner screws (6) and passing the opposite end through the connector (5); Progressive traction of all the wires (4) from their free ends that have passed through the connectors (5), by means of tighteners anchored on the wire-bar connectors (5), until obtaining approximation of the intermediate pincers (2) and the vertebrae to which they are attached to the longitudinal bar (1), thus completing correction

of the curvature; Replacement of the wires (4) by lateral pincer-bar connectors (3) when this is possible due to the proximity of the pincer to the bar

2. Device for putting the procedure described in claim 1 into practice, **characterized by** the fact that it consists of the following elements: Pincers (2) attached to the vertebrae through their laminar or pedicular zone, formed by two curved claws with opposite concavities, one of which (7) forms part of the body (8) of the pincer and the other (9) independent, with a cylindrical lateral prolongation which on passing tightly through the body of the pincer allows it to make axial or turning displacements to adapt the relative position of the two claws to the shape and sizes of the zone of the vertebra where it is fastened. There is a prisoner screw (11) for
3. immobilization of the movable claw (9) in the suitable position, as well as another prisoner screw (12) to retain insertion of the connecting prolongation (13) of the pincer-bar connectors (3) and tautening wire (4) through-orifice (14) for lateral displacement of the vertebrae; Pincer-bar connectors (3) that have an orifice or groove (15) for tight housing of the bar with a prisoner screw (16) for its immobilization in the suitable position and a lateral cylindrical prolongation (13) for connection to the corresponding pincer (2); Wire-bar connectors (5) formed by a polyhedral body (18) with beveled edges, crossed by a groove or longitudinal orifice (19) through which the bar (1) passes and to which it is attached by means of a prisoner screw (20), and by an orifice (21) with two paths (side inlet and upper outlet), joined by curved transition (22) through which the wire (4) passes and a prisoner screw (17) to retain it; Braided metallic wires (4) the progressive pulling of which nears the pincers (2) and the vertebrae to which they are attached to the bar (1). For this purpose a low cylindrical butt (23) is provided on the end projecting through the body (8) of the pincer (2).

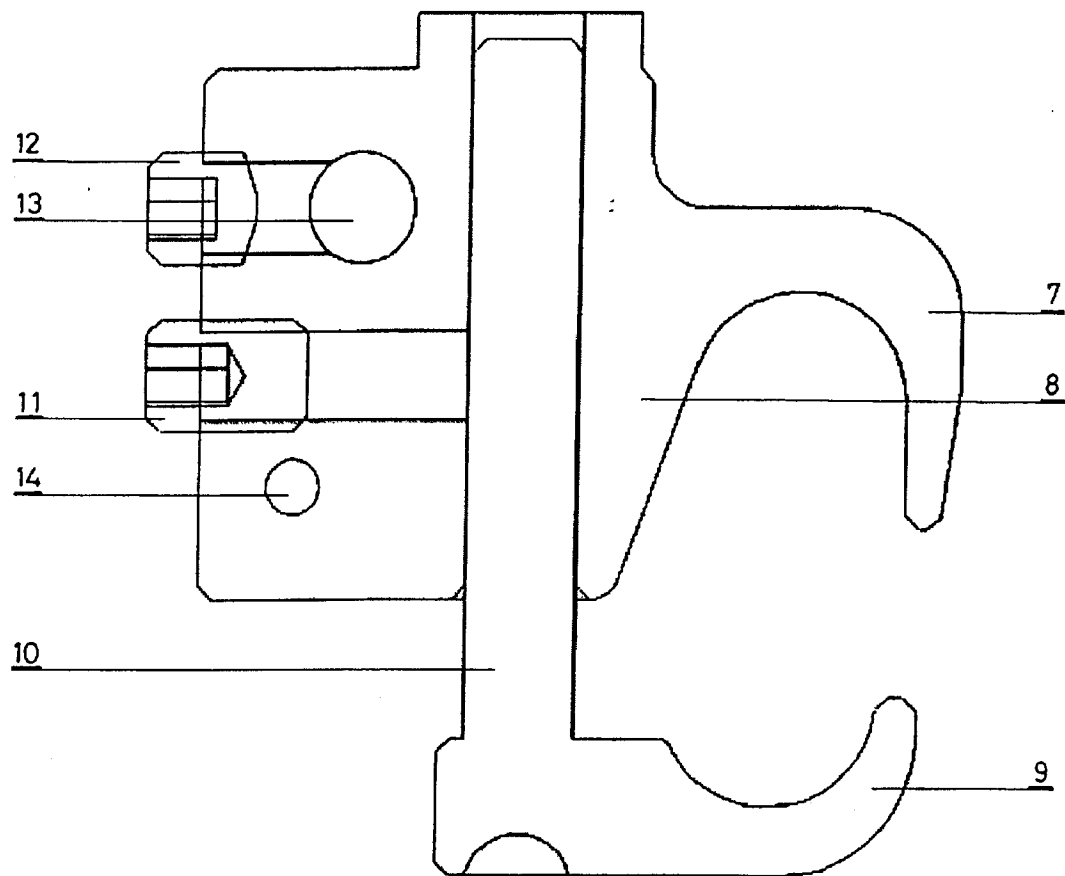


FIG.1

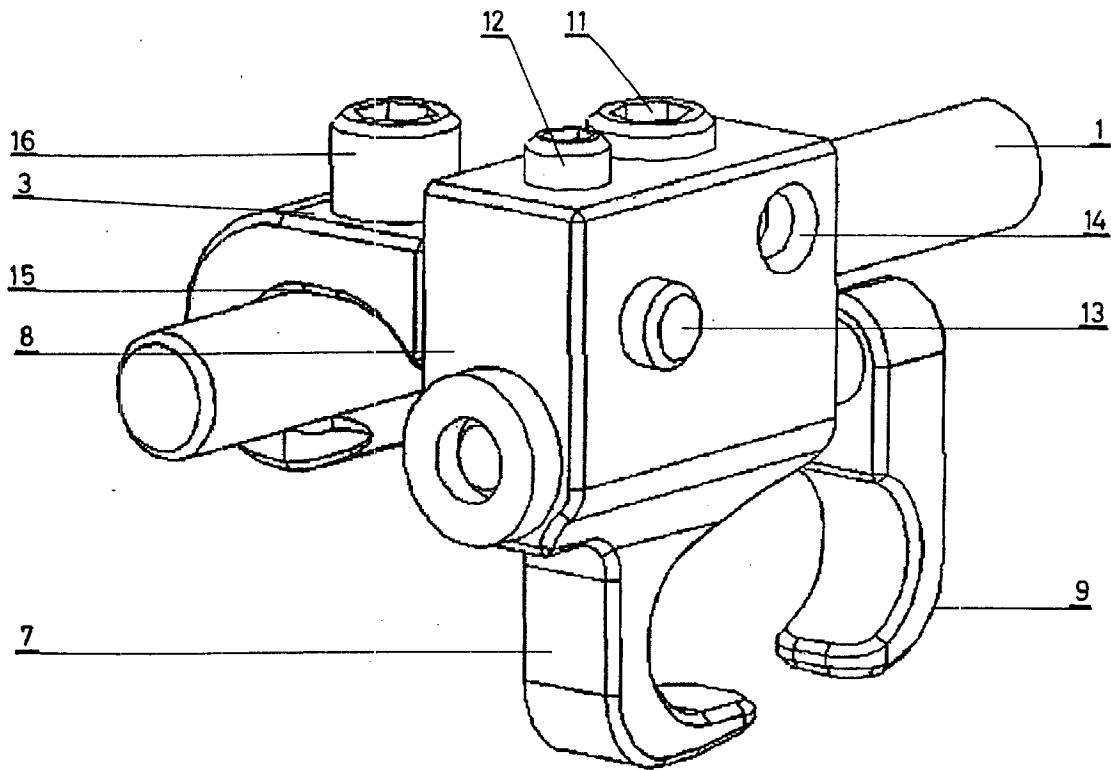


FIG. 2

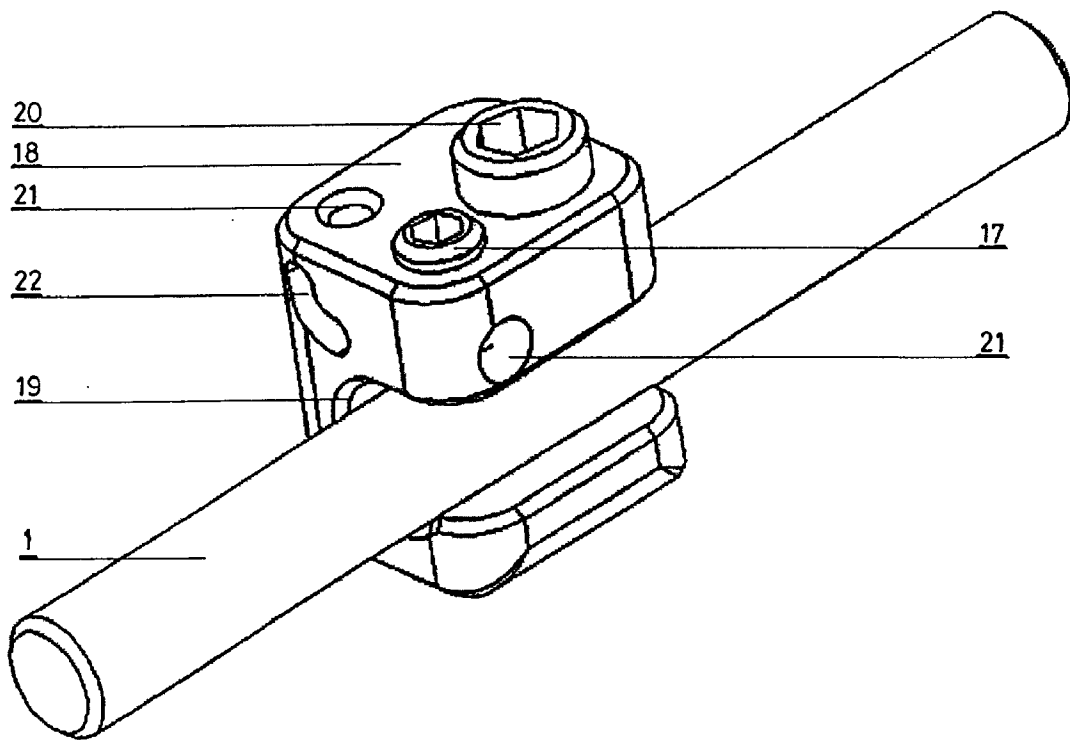


FIG. 3

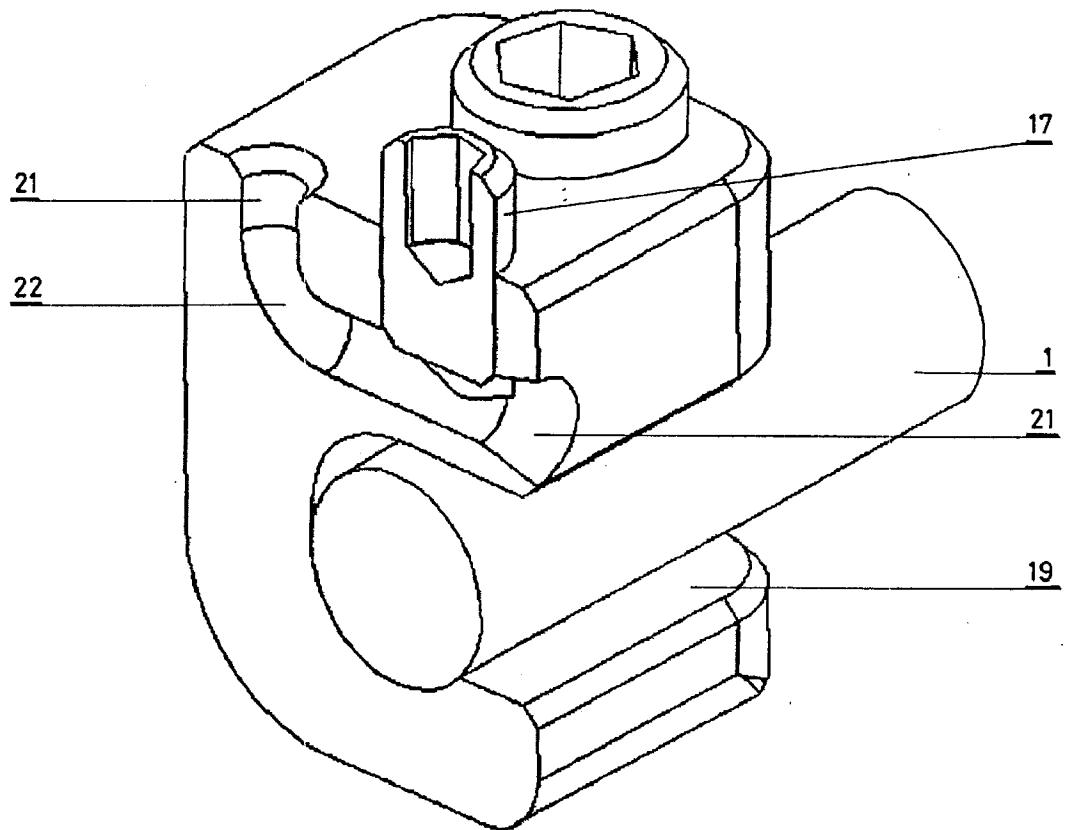


FIG.4

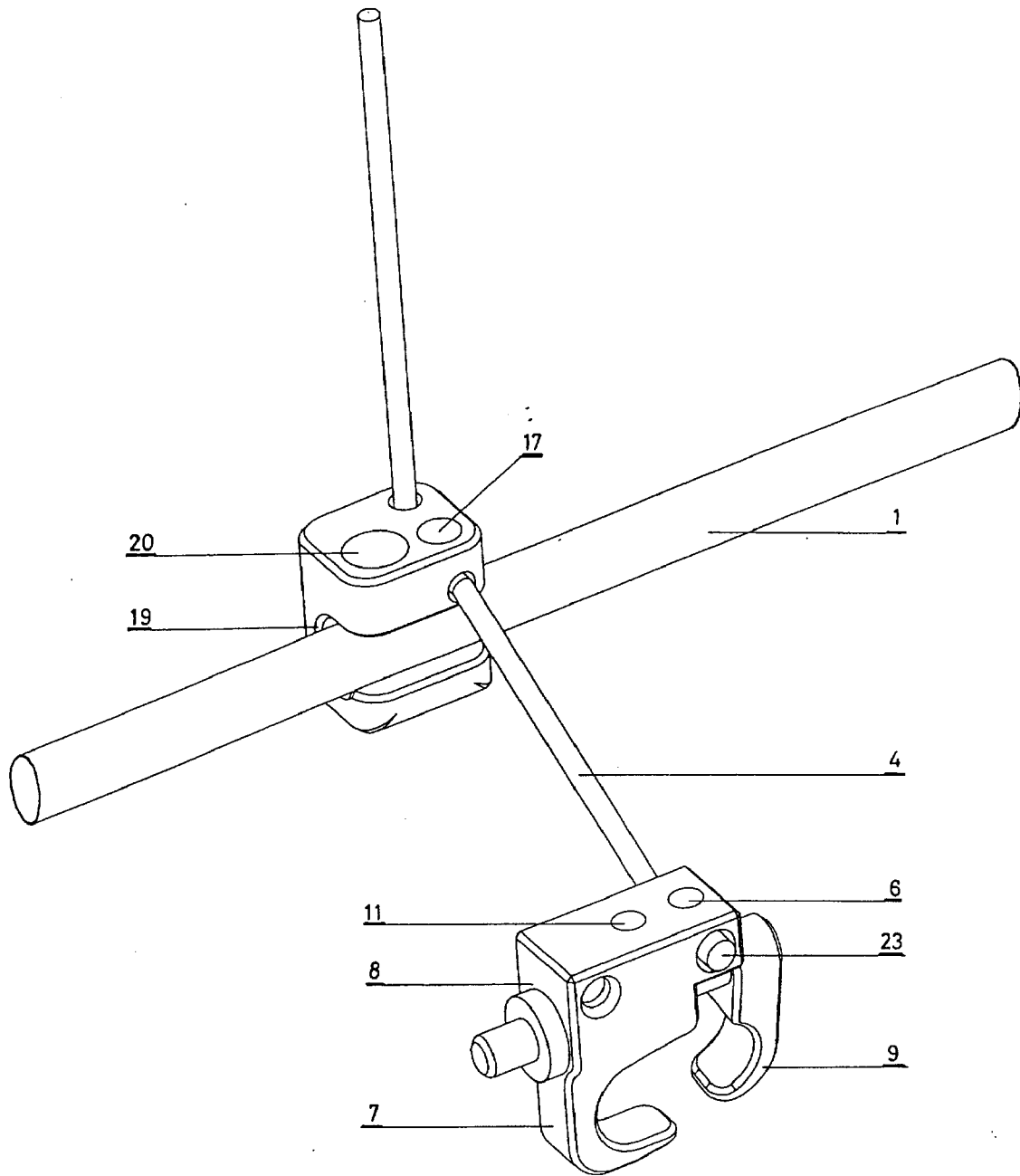


FIG. 5

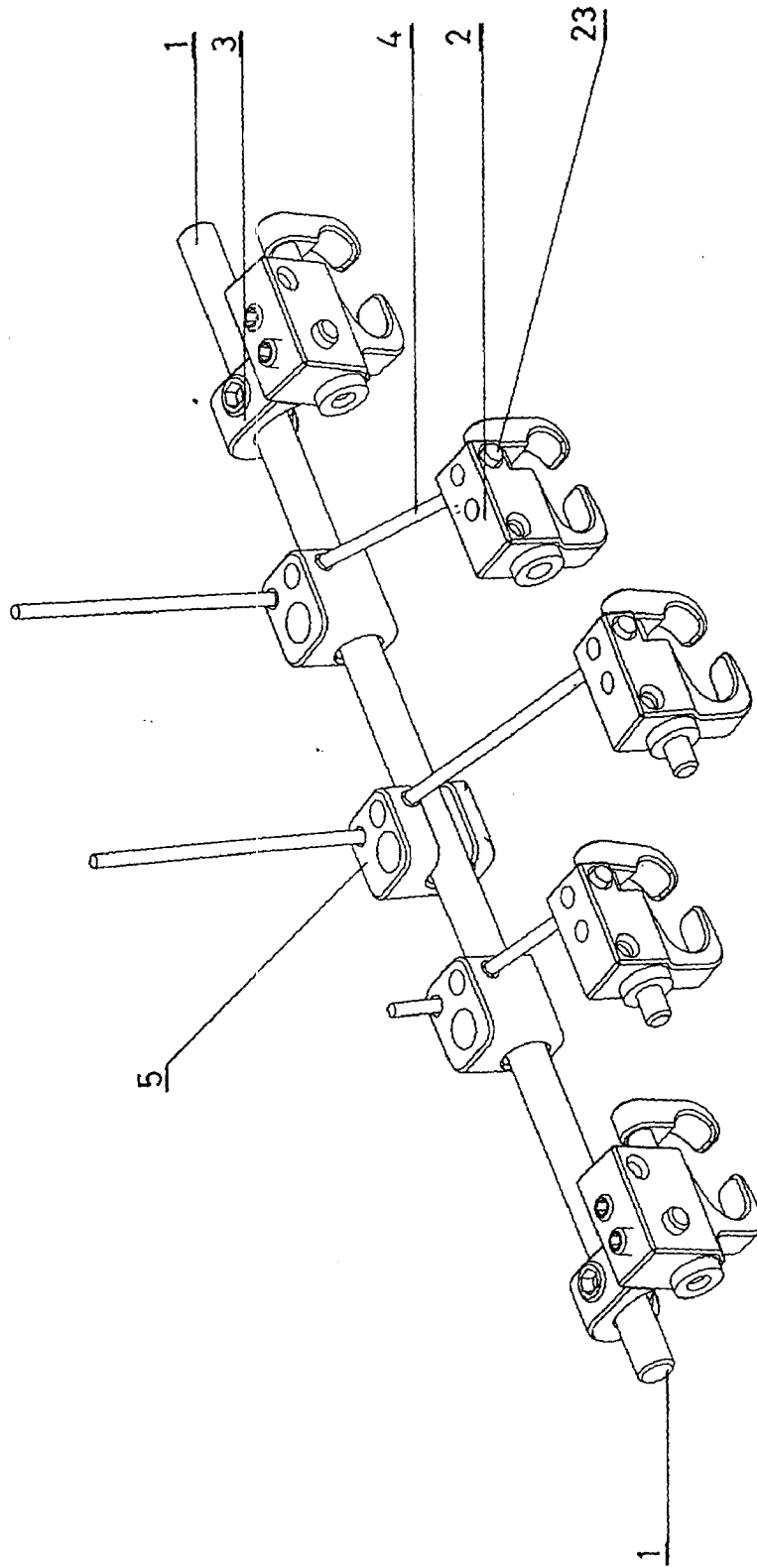


FIG 6

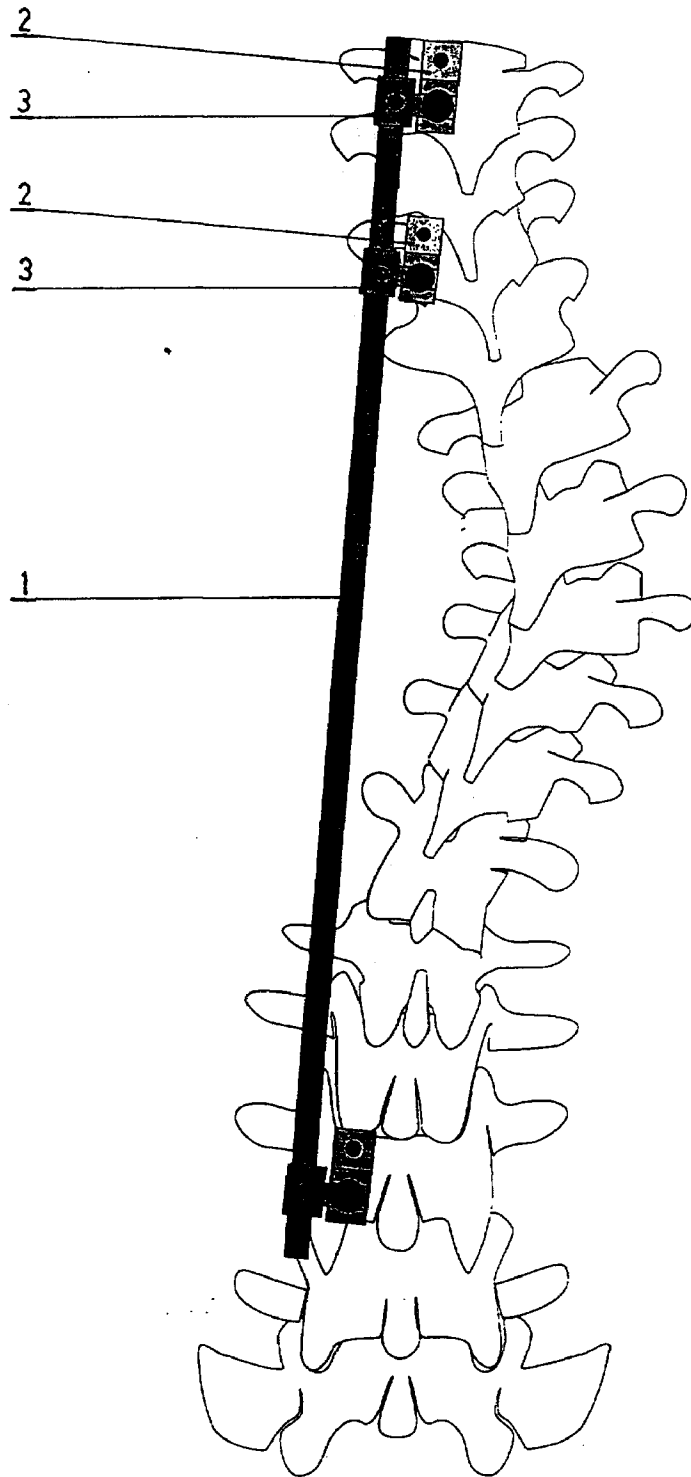


FIG. 7

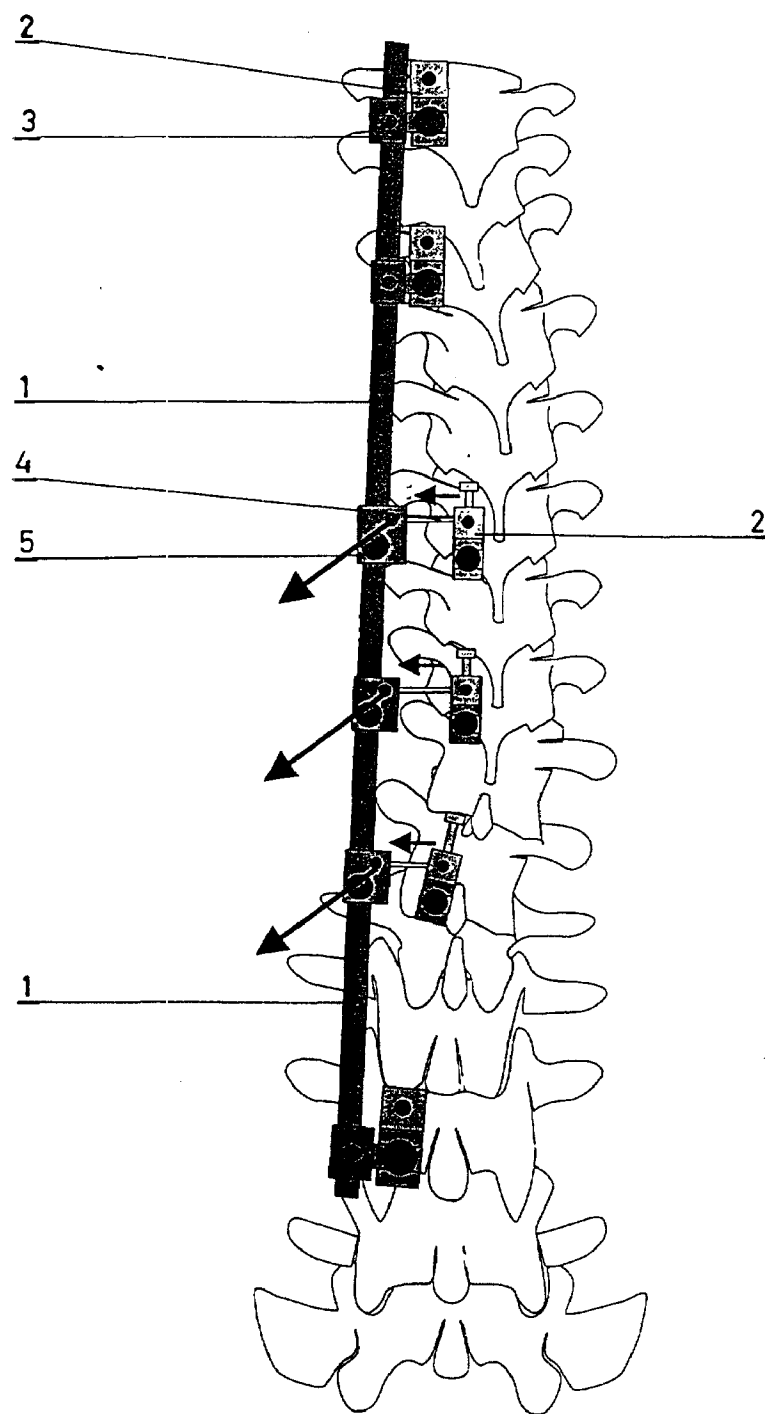


FIG. 8

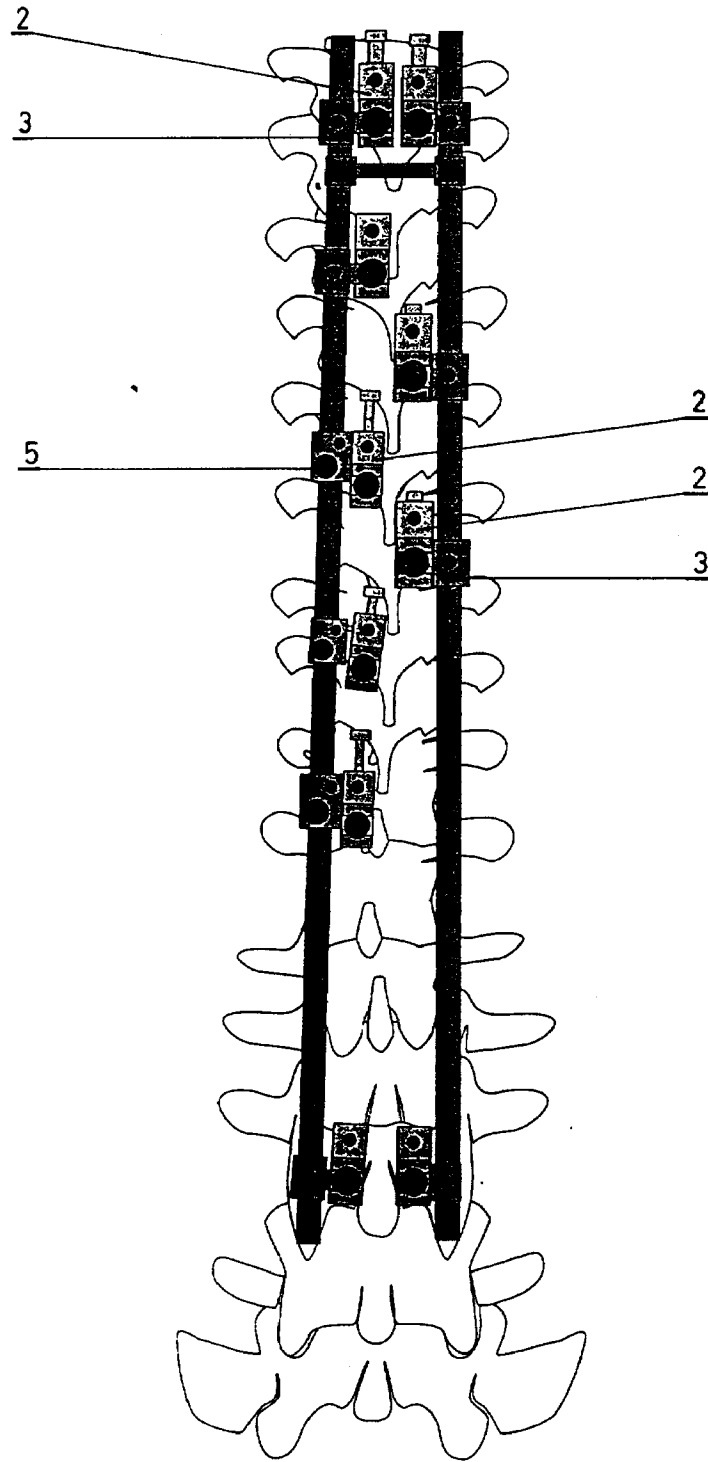


FIG. 9



European Patent
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PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

EP 00 50 0231

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 4 269 178 A (KEENE JAMES S) 26 May 1981 (1981-05-26) * column 1, line 47 - column 3, line 39; figures 1-4 *	2	A61B17/70
Y	DE 28 45 647 A (MESSERSCHMITT BOELKOW BLOHM) 8 May 1980 (1980-05-08) * column 1, line 47 - column 3, line 39; figures 1-4 *	2	
A	DE 197 38 968 A (PLUS ENDOPROTHETIK AG) 18 February 1999 (1999-02-18) * column 2, line 59 - line 68 * * column 4, line 4 - line 7 *	2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A61B
INCOMPLETE SEARCH			
<p>The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.</p> <p>Claims searched completely :</p> <p>Claims searched incompletely :</p> <p>Claims not searched :</p> <p>Reason for the limitation of the search:</p> <p>see sheet C</p>			
Place of search		Date of completion of the search	Examiner
MUNICH		8 August 2001	Georgiou, Z
CATEGORY OF CITED DOCUMENTS		<p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>	
<p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p>			

EPO FORM 1505 03.82 (P04C07)



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INCOMPLETE SEARCH
SHEET C

Application Number
EP 00 50 0231

Although claims are directed to a method of treatment of the human/animal body (Article 52(4) EPC), the search has been carried out and based on the alleged effects of the compound/composition.

Claim(s) searched incompletely:

2

Claim(s) not searched:

1

Reason for the limitation of the search (non-patentable invention(s)):

Claim 1 relates to a method for treatment of the human or animal body by therapy or surgery (Art. 52(4) EPC).
Claim 2 is not comprehensible as to which technical features form part of its subject-matter. It was interpreted as defining:
Device for correcting spinal malformations comprising pincers (2) each having a body (8) and two curved claws (7,9) with opposite concavities, one claw (7) forming part of the body (8) the other claw (9) being separate and having a cylindrical protrusion for passing through a hole in the body (8) and thus able for axial displacement and rotation for adapting to the anatomy of the vertebra to be fastened on, the body further comprising a set screw (11) for securing the protrusion of the separate claw (9), the device further comprising a pincer-bar connector (3) securable to the pincer by means of a set screw (12), a wire (4) one end of which is securable to a pincer (2) by means of a set screw (6); and wire-bar connectors (5) having an orifice or groove (19) through which a longitudinal fixation bar (1) may pass and an orifice (21) through which the wire can pass and is able to be fixed by a further set screw (17).

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 50 0231

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-08-2001

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EPO FORM P0453

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82